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**Abstract**—This manual shows how to teach C programming to beginners using the arduino and a seven segment display. All basic concepts like conditional statements, loops, arrays and functions are covered.

**Problem 1.** Connect the arduino to the seven segment display in Fig. 1.

Component	Value	Quantity
Breadboard		1
Resistor	$\geq 220\Omega$	1
Arduino	Uno	1
Seven Segment Display	Common Anode	1
Jumper Wires		20

TABLE 1

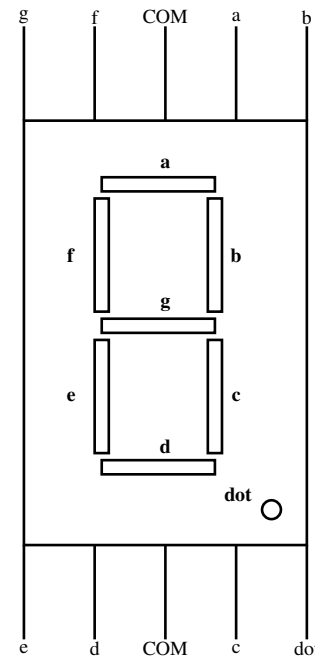


Fig. 1

**Problem 2.** Run the following program and test for dec=0 and dec=8.

```
//Code released under GNU GPL.
  Free to use for anything.
//Remove the following line if you
  are using the Arduino IDE
#include "Arduino.h"

int dec = 0;
void setup()
{
  // initialize LED digital pin as
  an output.
  pinMode(2, OUTPUT); // a
  pinMode(3, OUTPUT); // b
  pinMode(4, OUTPUT); // c
```

```
  pinMode(5, OUTPUT); // d
  pinMode(6, OUTPUT); // e
  pinMode(7, OUTPUT); // f
  pinMode(8, OUTPUT); // g
}

void loop()
{
  if (dec==8)
  {
    digitalWrite(2,0);
    digitalWrite(3,0);
    digitalWrite(2,0);
    digitalWrite(5,0);
    digitalWrite(6,0);
    digitalWrite(7,0);
    digitalWrite(8,0);
```

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```

}
else if (dec==0)
{
    digitalWrite(2,0);
    digitalWrite(3,0);
    digitalWrite(2,0);
    digitalWrite(5,0);
    digitalWrite(6,0);
    digitalWrite(7,0);
    digitalWrite(8,1);
}
}

```

**Problem 3.** Extend the previous program for all numbers between 0-9. Print E on the display if the input is not in this range.

**Problem 4.** Write a function for writing a decimal number to the seven segment display.

```

//Code released under GNU GPL.
//Free to use for anything.
//Remove the following line if you
//are using the Arduino IDE
#include "Arduino.h"

void sevensseg(int);
void setup()
{
    // initialize LED digital pin as
    // an output.
    pinMode(2, OUTPUT); //a
    pinMode(3, OUTPUT); //b
    pinMode(4, OUTPUT); //c
    pinMode(5, OUTPUT); //d
    pinMode(6, OUTPUT); //e
    pinMode(7, OUTPUT); //f
    pinMode(8, OUTPUT); //g
}

void loop()
{
    sevensseg(5);
}

void sevensseg(int dec)
{
    int a=0,b=0,c=0,d=0,e=0,f
    =0,g=0;

```

```

switch (dec)
{
    case 0:
        g=1;
        break;
    case 1:
        a=1,d=1,e
        =1,f=1,g
        =1;
        break;
    case 2:
        c=1,f=1;
        break;
    case 3:
        e=1,f=1;
        break;
    case 4:
        a=1,d=1,e
        =1;
        break;
    case 5:
        b=1,e=1;
        break;
    case 6:
        b=1;
        break;
    case 7:
        d=1,e=1,f
        =1,g=1;
        break;
    case 8:
        break;
    case 9:
        e=1;
        break;
    default:
        b=1,c=1;
        break;
}

digitalWrite(2,a);
digitalWrite(3,b);
digitalWrite(4,c);
digitalWrite(5,d);
digitalWrite(6,e);
digitalWrite(7,f);
digitalWrite(8,g);
}

```

**Problem 5.** Using the function in problem 4 and a for loop, implement a decade counter.

```
//Code released under GNU GPL.
  Free to use for anything.
//Remove the following two lines
  if you are using the Arduino IDE
//and include the sevenseg
  function definition after the
  loop function
#include "Arduino.h"
#include "sevenseg.h"

int i;
void sevenseg(int);
void setup()
{
  // initialize LED digital pin as
  an output.
  pinMode(2, OUTPUT); //a
  pinMode(3, OUTPUT); //b
  pinMode(4, OUTPUT); //c
  pinMode(5, OUTPUT); //d
  pinMode(6, OUTPUT); //e
  pinMode(7, OUTPUT); //f
  pinMode(8, OUTPUT); //g
}

void loop()
{
  for(i=0; i < 10; i++)
  {
    sevenseg(i);
    delay(1000);
  }
}
```

**Problem 6.** Repeat problem 4 using an array for pin numbering.

```
//Code released under GNU GPL.
  Free to use for anything.
//Remove the following line if you
  are using the Arduino IDE
#include "Arduino.h"

void sevenseg(int);
```

```
void setup()
{
  // initialize LED digital pin as
  an output.
  pinMode(2, OUTPUT); //p[0]=a
  pinMode(3, OUTPUT); //p[1]=b
  pinMode(4, OUTPUT); //p[2]=c
  pinMode(5, OUTPUT); //p[3]=d
  pinMode(6, OUTPUT); //p[4]=e
  pinMode(7, OUTPUT); //p[5]=f
  pinMode(8, OUTPUT); //p[6]=g
}

void loop()
{
  sevenseg(0);
}

void sevenseg(int dec)
{
  int p[7], i;

  for (i=0; i < 7; i++)
    p[i] = 0;

  switch (dec)
  {
    case 0:
      p[6]=1;
      break;
    case 1:
      p[0]=1, p
      [3]=1, p
      [4]=1, p
      [5]=1, p
      [6]=1;
      break;
    case 2:
      p[2]=1, p
      [5]=1;
      break;
    case 3:
      p[4]=1, p
      [5]=1;
      break;
    case 4:
      p[0]=1, p
      [3]=1, p
      [4]=1;
      break;
  }
}
```

```

        case 5:
            p[1]=1,p
            [4]=1;
            break;
        case 6:
            p[1]=1;
            break;
        case 7:
            p[3]=1,p
            [4]=1,p
            [5]=1,p
            [6]=1;
            break;
        case 8:
            break;
        case 9:
            p[4]=1;
            break;
        default:
            p[1]=1,p
            [2]=1;
            break;
    }

    for (i=0;i < 7; i++)
        digitalWrite(i+2,p
            [i]);
}

```

**Problem 7.** Repeat problem 2 by using the switch-case statements.

**Problem 8.** Repeat problem 5 by using a while loop.

**Problem 9.** Repeat 5 using a do-while loop.

**Problem 10.** Implement decimal to binary conversion and test your logic using the display.

```

//Code released under GNU GPL.
Free to use for anything.
//Remove the following line if you
are using the Arduino IDE
#include "Arduino.h"

void binsevenseg(int ,int ,int ,int );
void setup()

```

```

{
    int i;
    // initialize LED digital pin as
    an output.
    for (i=0;i < 7; i++)
        pinMode(i+2,
            OUTPUT);
}

void loop()
{
    int dec = 5;
    int E,F,G,H;

    //decimal to binary conversion
    E = dec%2;
    dec = dec/2;
    F = dec%2;
    dec = dec/2;
    G = dec%2;
    dec = dec/2;
    H = dec%2;

    binsevenseg(E,F,G,H);
}

//function for binary to seven
segment display
void binsevenseg(int A, int B, int
    C, int D)
{
    int p[7],i;

    p[0] = A&&!B&&!C&&!D || !A&&!B&&C
        &&!D;
    p[1] = A&&!B&&C&&!D || !A&&B&&C&&!
        D;
    p[2] = !A&&B&&!C&&!D;
    p[3] = A&&!B&&!C&&!D || !A&&!B&&C
        &&!D || A&&B&&C&&!D;
    p[4] = A&&!B&&!C&&!D || A&&B&&C
        &&!D || !A&&!B&&C&&!D || A&&!B&&
        C&&!D || A&&B&&C&&!D || A&&!B&&!
        C&&D;
    p[5] = A&&!B&&!C&&!D || !A&&B&&C
        &&!D || A&&B&&C&&!D || A&&B&&C
        &&!D;
    p[6] = !A&&!B&&C&&!D || A&&!B&&C
        &&!D || A&&B&&C&&!D;
}

```

```
    for (i=0; i < 7; i++)  
        digitalWrite(i+2,p  
            [i]);  
}
```

**Problem 11.** Implement decimal to binary conversion using a for loop and arrays.

**Problem 12.** Repeat the above exercise using a while loop.

**Problem 13.** Repeat the above exercise using a do-while loop.

**Problem 14.** Repeat the above exercise by using a function.